Instructor: Dr. Zeynep Dilli, dilli@umd.edu  
Office Hours: MW 1:00 pm-2:00 pm  
Office: AVW 2332  

TA: Kyungjin Yoo, athleta@umd.edu  
Office Hours: To be announced  
Office: To be announced

Lecture Schedule: MW 11:00 am-12:15 pm (CSS 2324)  
Recitation Schedule: Section 0101: Th......... 11:00 am-11:50 am (EGR 3114)  
Section 0102: Th......... 12:00 pm-12:50 pm (EGR 0135)

Course Description: This course covers the physics, structure and conduction processes of semiconductors, followed by a detailed study of pn-junction diodes, metal oxide field effect transistors and bipolar junction transistors.

Course Objective: This course aims to introduce the student to the physical principles and processes which have made the semiconductor revolution possible, along with an understanding of the operation principles of the basic devices upon which modern electronics is built. By the end of the class, students should be ready to study more in-depth physics, or more advanced devices being developed even now as device technology progresses. The student should also gain some understanding of the issues and trade-offs involved in device-level design.


Optional Texts: At the end of each chapter there is a suggested reading list. Most of these texts listed are available in the library.

Class Website: Materials such as announcements, homeworks, homework solutions, quiz questions and solutions will be posted online. The website for the course is at http://www.ece.umd.edu/~dilli/courses/enee313_spr09/  

Course Policies:  
Grading: The points available are broken down as follows:  
- Quizzes 10 %  
- Homework 16 %  
- Midterm 1 23 %  
- Midterm 2 23 %  
- Final Exam 28 %

Partial Credit: Partial credit will be granted for incomplete solutions showing work towards the final answer. However, just the answer without any work shown towards it is not acceptable. This policy holds for homework, quiz and examination grading.

Exams: There will be three exams, two midterms and a final exam. (Dates to be announced.) Extra materials to assist exam preparation will be posted on the website ahead of time. There will be a short (~10 min.) quiz given at the start of class of some classes. These will typically test material covered during the previous week and will be announced ahead of time (i.e. no “pop-quizzes”). We will try to have at least ten quizzes throughout the semester and the worst two grades for each student will be discarded when taking the final average. This also means that you can miss two quizzes and have those discounted as your two worst grades.
Course Agenda:

1. **Crystal Properties**
   - Crystal structure of Si

2. **Atoms and Electrons**
   - Bohr model
   - Introduction to quantum mechanics

3. **Energy Bands and Charge carriers in semiconductors**
   - Energy bands in solids
   - Charge carriers in semiconductors and carrier concentrations
   - Carriers in fields

4. **Excess carriers**
   - Luminescence and carrier lifetime
   - Drift and diffusion, built-in fields
   - Recombination and the continuity equation

5. **The p-n junction and some of its properties**
   - Depletion, fields and potentials
   - Behavior of the p-n junction under applied voltage
   - Depletion capacitance
   - Diffusion capacitance
   - Current flow through the p-n junction
   - The ideal diode equation

6. **Metal-Oxide-Semiconductor Field Effect Transistors (MOSFETs)**
   - Sub-threshold behavior
   - Thresholds
   - Linear and saturated operation
   - Capacitance
   - Physical structure and scaling laws

7. **Bipolar Junction Transistors (BJTs)**
   - BJT physics
   - Forward current gain

7. **Introduction to Semiconductor Fabrication and Layout**
   - Implementing devices on semiconductor wafers
   - Fabrication steps

**Other Considerations:** Students with special needs should contact the instructor individually to make any necessary arrangements.

There will be no make-up quizzes given except in extreme circumstances. Make-up examinations must typically be arranged with the instructor ahead of time.

**Recitations:** The TA may review topics, homework and quiz solutions, and answer questions during the discussion section.